(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平7－191142

(43)公開日　平成７年(1995)７月28日

(51)Int.Cl.[6]	識別記号	ＦＩ
G01S 17/02		
G01B 11/00	B	
G01C 3/06	Z	
G01S 7/48	A 4240-5J	
	4240-5J	G01S 17/02 A

審査請求　未請求　請求項の数３　ＦＤ　（全６頁）

(21)出願番号　特願平5－353622

(22)出願日　平成５年(1993)12月27日

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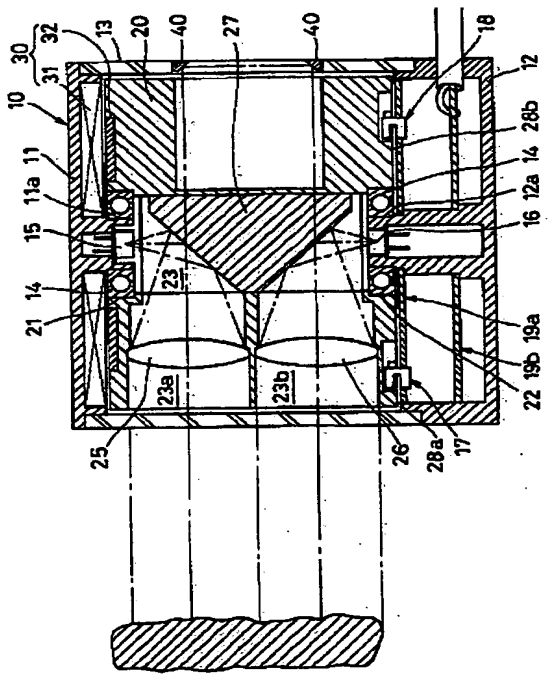
(54)【発明の名称】全方位距離検出装置

(57)【要約】
【目的】　光を物体に当て、その反射光に生じる位相差、時間差に基づいて物体までの距離を簡単な構成で精度良く検出すると共に、投・受光用の機器を集中配置し、これを中心にして装置全体を回転するようにして、物体の有無並びに物体が存在するときには物体までの距離をほぼ３６０度にわたって検出できるようにする。
【構成】　周壁が光学的に開放されたケーシング１０と、このケーシング内にほぼ鉛直軸まわりに回転可能に設けられたロータ２０と、このロータをケーシングに対して回転させる駆動機構３０とを備えると共に、上記ケーシングに、ロータ回転軸上で対向配置された投光器１５及び受光器１６と、ケーシングに対するロータの回転位置に応じて信号を出力する回転位置検出器１７とを設け、上記ロータに投光器及び受光器の光軸を検出方向に向くよう変換する光軸変換機構２７を設け、上記回転位置検出器の出力信号からロータの回転位置を、投光器の入力信号と受光器の出力信号との差から距離をそれぞれ検出できるようにした。



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【特許請求の範囲】

【請求項１】周壁が光学的に開放されたケーシングと、このケーシング内にほぼ鉛直軸まわりに回転可能に設けられたロータと、このロータをケーシングに対して回転させる駆動機構とを備えると共に、上記ケーシングに、ロータ回転軸上で対向配置された投光器及び受光器と、ケーシングに対するロータの回転位置に応じて信号を出力する回転位置検出器とを設け、上記ロータに投光器及び受光器の光軸を検出方向に向くよう変換する光軸変換機構を設け、上記回転位置検出器の出力信号からロータの回転位置を、投光器の入力信号と受光器の出力信号との差から距離をそれぞれ検出できるようにしたことを特徴とする全方位距離検出装置。

【請求項２】駆動機構が、ケーシング及びロータの対向する水平面に一体に設けたモータであり、このモータのコイルがケーシング側に、磁極がロータ側に設けられている請求項１記載の全方位距離検出装置。

【請求項３】ロータが基準回転位置にあるときに投光器と受光器とを一定の光路長さで光学的に結合させる基準機構をケーシングに設け、ロータが基準回転位置にきたときの出力により検出距離を補正できるようにした請求項１記載の全方位距離検出装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、周囲ほぼ３６０度にわたって物体の有無並びに物体が存在するときには物体までの距離を検出できる全方位距離検出装置に関する。

【０００２】

【従来の技術】従来、ある物体までの距離を検出する距離検出装置として、三角測量の原理を応用したものが知られている。これは所定間隔だけ離して投光素子と、位置検出が可能な受光素子とを設け、投光素子からの光を物体に当て、その反射光を受光素子で受け、その受光位置の基準位置からの「ずれ」を測定し、この「ずれ」量に基づいて幾何学的に物体までの距離を検出するようにしたものでる。

【０００３】

【発明が解決しようとする課題】しかし、上記従来のものでは幾何学的に距離を検出するから、投光素子及び受光素子の取付位置が若干でもずれていると検出距離が実際の距離から狂ってしまう。従って、装置全体の光学的精度を高レベルに維持する必要があり、そのために装置の製造及び管理に手間を要した。また、光軸の変動を問題とするから、投光素子と受光素子との間でやりとりする光はスポット的な光であることが要求され、そのために光学系が複雑になったり、高価なレーザー光を必要とする場合があった。

【０００４】また、このような距離検出装置としては検出範囲を所定角度内に限定した検出にとどまらず、広範囲にわたって精度良く距離検出を行いたいという要望がある。

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【０００５】本発明は、このような点に着目してなされたものであり、その目的とするところは、発光ダイオード等による光を物体に当て、その反射光に生じる位相差又は時間差に基づいて物体までの距離を簡単な構成で精度良く検出すると共に、投・受光用の機器を集中配置し、これを中心にして装置全体を回転するようにして、物体の有無並びに物体が存在するときには物体までの距離をほぼ３６０度にわたって検出できるようにすることにある。

【０００６】

【課題を解決するための手段】上記目的を達成するため、請求項１の全方位距離検出装置は、周壁が光学的に開放されたケーシングと、このケーシング内にほぼ鉛直軸まわりに回転可能に設けられたロータと、このロータをケーシングに対して回転させる駆動機構とを備えると共に、上記ケーシングに、ロータ回転軸上で対向配置された投光器及び受光器と、ケーシングに対するロータの回転位置に応じて信号を出力する回転位置検出器とを設け、上記ロータに、投光器及び受光器の光軸を検出方向に向くよう変換する光軸変換機構を設け、上記回転位置検出器の出力信号からロータの回転位置を、投光器の入力信号と受光器の出力信号との差から距離をそれぞれ検出できるようにした。

【０００７】また、請求項２の全方位距離検出装置は、上記構成において、駆動機構が、ケーシング及びロータの対向する水平面に一体に設けたモータであり、このモータのコイルがケーシング側に、磁極がロータ側に設けられている。

【０００８】さらに、請求項３の全方位距離検出装置は、請求項１の構成において、ロータが基準回転位置にあるときに投光器と受光器とを一定の光路長さで光学的に結合させる基準機構をケーシングに設け、ロータが基準回転位置にきたときの出力により検出距離を補正できるようにした。

【０００９】

【作用】請求項１では、投光器の光は光軸変換機構を介して物体に当たり、その反射光が光軸変換機構を介して受光器に入る。そして投光器の入力信号と受光器の出力信号との位相差又は時間差から物体までの距離が検出される。そして、駆動機構の作動によりロータがケーシングに対して回転するから、物体までの距離がほぼ３６０度にわたって検出される。その場合、回転位置検出器の出力に基づいてケーシングに対するロータの回転位置が検出される。

【００１０】請求項２では、コイルに誘導電流を流せばモータが機能してロータがケーシングに対して回動する。

【００１１】請求項３では、ロータが基準回転位置にくると投光用レンズと受光用のレンズとが一定の光路長さ

で光学的に結合するから、そのときの投光器の入力信号と受光器の出力信号との位相差又は時間差が上記光路長さに応じた基準値として認識され、これを零距離とした補正が可能になる。

【００１２】

【実施例】以下、実施例を説明する。図１において１０は円柱形のケーシングであって、円盤形の上板１１及び下板１２と、これら上板１１と下板１２とを連結する円筒形の連結筒１３とを備えており、この連結筒１３を透明樹脂で形成することによりケーシング１０の周壁を光学的に開放している。上記ケーシング１０の上板１１及び下板１２の中心において相対向する部位には互いに近づくように立ち上がる突成部１１ａ，１２ａが形成され、ここにラジアルベアリング１４，１４がその内輪において嵌合している。２０はケーシング１０の上板１１と下板１２との間に配置された円柱形のロータであって、このロータ２０の上面及び下面の中心部には上記ラジアルベアリング１４，１４の外輪に嵌合する嵌合穴２１，２２が形成され、この嵌合穴２１と嵌合穴２２との間は開放されていて光路となる空間２３になっている。以上の構成によってロータ２０がケーシング１０内でほぼ鉛直軸まわりに回転できるように構成されている。そして、３０はロータ２０をケーシング１０に対して回転させる駆動機構としてのモータであって、このモータ３０はケーシング１０及びロータ２０の対向する水平面に一体に設けられている。すなわち、ケーシング上板１１の下面には平面視で等角度間隔でコイル３１が設けられていると共に、ロータ２０の上面には平面視で等角度間隔で永久磁石よりなる磁極３２が設けられており、各コイル３１に流す誘導電流を制御することにより、ロータ２０が所定回転数で回転する。

【００１３】上記ケーシング上板１１の突成部１１ａの中心には投光器として発光ダイオード１５が光軸を真下に向けて装着されており、またケーシング下板１２の突成部１２ａの中心には受光器としてのフォトダイオード１６が光軸を真上に向けて装着されていて、発光ダイオード１５とフォトダイオード１６とがロータ回転軸上で対向配置されている。一方、上記ロータ２０では上述した空間２３が一側壁（図１では左側壁）において開放され、且つ隔壁によって上下２つの筒形空間２３ａ，２３ｂに分割されており、この空間２３ａ，２３ｂに投光用レンズ２５及び受光用レンズ２６が光軸を検出方向である側方（図１では左方）に向けてそれぞれ配置されている。また上記空間２３の内方には光軸変換機構としてのミラー２７が設けられている。このミラー２７は中心軸がロータ回転軸に一致するように配置された円柱形の本体の上下端面を約４５度の角度で切除して得た形状であり、この切除面を反射面としたものである。このミラー２７の２つの反射面により上記発光ダイオード１５及びフォトダイオード１６の光軸を投光用レンズ２５及び受光用レンズ２５の光軸に変換するようにしている。従って、発光ダイオード１５の光はミラー２７及び投光用レンズ２５を介して物体Ｘに当たり、その反射光が受光用レンズ２６及びミラー２７介してフォトダイオード１６に入る。

【００１４】また上記ケーシング１０の連結筒１３において周方向の一箇所には基準機構４０が固定されている。この基準機構４０は上下に対向する一対のプリズムを有しており、上側のプリズムが投光用レンズ２５の高さで斜め下向きに、そして下側のプリズムが受光用レンズ２６の高さで斜め上向きにそれぞれ設定されている。従ってロータ２０が図１の状態から１８０度回転して基準回転位置にきたときに投光用レンズ２５からの光が上下のプリズムで１８０度角度を変えてから受光用レンズ２６に入り、これによってロータ２０が基準回転位置にあるときに投光用レンズ２５と受光用のレンズ２６とが一定の光路長さで光学的に結合するようになっている。ここで、上記基準機構４０の外周側に遮光シールを貼るなどして遮光処理することによりプリズムを通過した検査光が外部にもれないようにすることが望ましい。こうすれば基準値に誤差が生じないので精度が上がる。また遮光処理面の内面で反射した検査光も基準値の形成に寄与する。

【００１５】また、図１において１７及び１８はケーシング１０に固定されてエンコーダとして機能する第１及び第２の光学式の回転位置検出器であって、ロータ２０の下面に設けられた第１及び第２の遮光板２８ａ，２８ｂをそれぞれ跨ぐようにケーシング下板１２に固定されている。上記第１遮光板２８ａの内周縁には多数の切り欠きが等間隔で設けられ、また第２遮光板２８ｂの外周縁には切り欠きが１箇所だけ設けられていて、これらの切り欠きが回転位置検出器１７，１８の光の通過を許容することに応じてパルス信号が出力される。ここで、第２遮光板２８ｂの切り欠きはロータ２０が基準回転位置にきたときに第２回転位置検出器１８にくるよう位置調整されている。図４のＲはロータ２０の回転に伴う第１回転位置検出器１７の出力信号であり、６は第２回転位置検出器１８の出力信号である。

【００１６】さらに、図１において１９ａ及び１９ｂは回路基板であって、この回路基板１９ａ，１９ｂに制御回路５０が組まれており、この制御回路５０に上記発光ダイオード１５、フォトダイオード１６及び第２回転位置検出器１８が電気的に接続されている。上記制御回路５０等の構成を図２及び図３で説明する。５１は所定周波数でクロック信号を出力する発振回路、５２は発振回路５１のクロック信号に基づいて発光ダイオード１５へ送る信号を調整する投光回路である（その出力は図３の１）。一方、５３はフォトダイオード１６の出力を増幅するリミッタアンプ（その出力は図３の２）、５４はスイッチング回路である（その出力は図３の３）。また５

５は上記投光回路５２の出力及びスイッチング回路の出力の位相を比較する位相比較器（その出力は図３の４）、５６は積分回路（その出力は図３の５）、５７は次のトリガが入るまでは入力信号のレベルを維持するサンプルホールド回路であって、その入力信号として積分回路５６が入り、またトリガとして第２回転位置検出器１８の信号が入っている。５８は差動アンプであって、積分回路５６の出力からサンプルホールド回路５７の出力を差し引いた値を出力する。この差動アンプ５８の出力（距離出力）は発光ダイオード１５の入力信号とフォトダイオード１６の出力信号の位相差又は時間差に応じた値になっているから、この値から物体までの距離が検出される。

【００１７】そして、この状態でモータ３０の作動によりロータ２０がケーシング１０に対して回転すると、差動アンプ５８の距離出力が光軸方向にある物体との距離に応じて変動し、これを検出することによって物体の有無並びに物体が存在するときには物体までの距離が周囲ほぼ３６０度にわたって検出される。すなわち、図４の５は積分回路５６の出力、図４の７は第２回転位置検出器１８の信号を受けた時点で更新されるサンプルホールド回路５７の出力であって、差動アンプ５８からこれらの差が出力される（図４の８）。従ってロータ２０が基準回転位置にきたときの積分回路５６の出力を基準値として、これを零距離とした補正がされる。そして、別途に第１回転位置検出器１７の出力信号（角度信号）からロータ２０の回転位置を検出する。なお、外部へ取り出せる出力信号としては、差動アンプ５８の距離出力と、第１回転位置検出器１７の角度信号と、第２回転位置検出器１８の基準位置信号とが設定されており、これらの出力信号を適宜加工して用いることができる。

【００１８】従って、上記実施例においては、光の位相差に基づいて物体Ｘまでの距離を簡単な構成で精度良く検出できると共に、装置全体を回転させて物体Ｘの有無並びに物体Ｘが存在するときには物体までの距離をほぼ３６０度にわたって検出することができる。また駆動機構３０をケーシング１０及びロータ２０に一体に設けたモータで構成したので、全体の構成をコンパクト化できる上、回転騒音を低減できる上、ブラシレスタイプなのでブラシの摩耗による寿命の低下がない。さらに基準機構４０を設けたので、ロータ２０が基準回転位置にきたときの出力により検出距離を補正して常に物体Ｘまでの距離を正確に検出することができる。

【００１９】なお、上記実施例ではケーシング１０に透明な連結筒１３を設けたが、連結筒を設けずに完全に開放する構成であってもよく、要は周壁が光学的に開放されておればよい。また駆動機構としてはロータの周壁にギヤを刻設し、これをピニオンで駆動する構成、ロータ

の周壁に駆動用アイドラを当接させる構成、その他種々の構成が考えられる。また投光器及び受光器の位置は上下に逆転してもよい。上記実施例では投光レンズ及び受光レンズを投光器及び受光器と別に設けたが、レンズ付きの投光器及び受光器を使用してもよいし、投光レンズ及び受光レンズを使用しなくてもよい。さらに光軸変換機構はミラー以外にプリズムが使用できる。

【００２０】

【発明の効果】以上説明したように、請求項１の全方位距離検出装置は、ロータをケーシングに対して回動させ、このケーシングに投光器及び受光器をロータ回転軸上で対向するよう配置し、ロータに投光器及び受光器の光軸を検出方向に向くよう変換する光軸変換機構を設け、回転位置検出器の出力信号からロータの回転位置を、投光器への入力信号と受光器からの出力信号との差から距離をそれぞれ検出できるようにしたので、光の位相差又は時間差に基づいて物体までの距離を簡単な構成で精度良く検出できると共に、装置全体を回転させて物体の有無並びに物体が存在するときには物体までの距離をほぼ３６０度にわたって検出することができるものであり、例えば自走式ロボット等において障害物を認識するために搭載する距離検出装置として好適である。

【００２１】また請求項２の全方位距離検出装置は、駆動機構をケーシングに設けたコイルとロータに設けた磁極とからなるモータで構成したので、ロータをケーシングに対して回動させる駆動機構の具体的な例を示すことができた。

【００２２】さらに請求項３の全方位距離検出装置は、ロータが基準回転位置にあるときに投光器と受光器とを一定の光路長さで光学的に結合させる基準機構をケーシングに設けたので、ロータが基準回転位置にきたときの出力により検出距離を補正して常に物体までの距離を正確に検出することができる。

【図面の簡単な説明】

【図１】実施例の縦断側面図、

【図２】実施例の制御回路のブロック図、

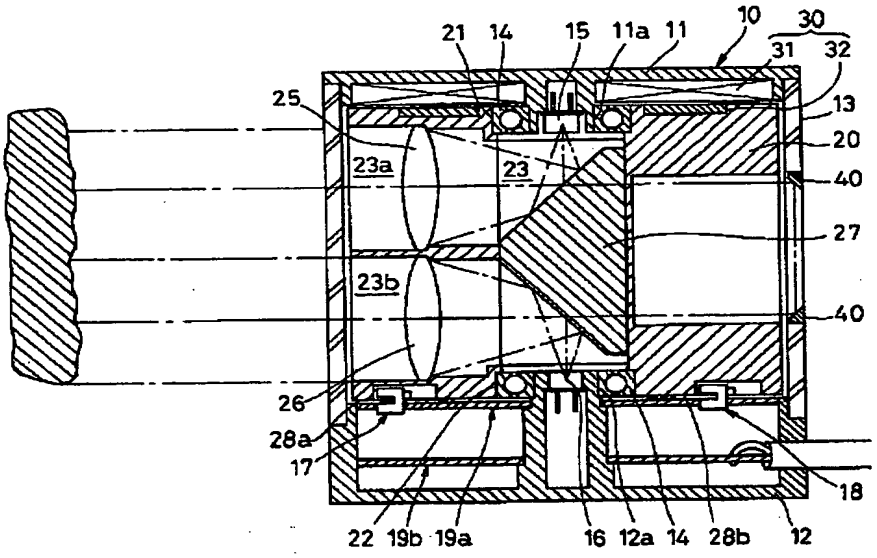
【図３】実施例の制御回路の基本作動を示す図、

【図４】同じくロータ回転時の制御回路の作動を示す図である。

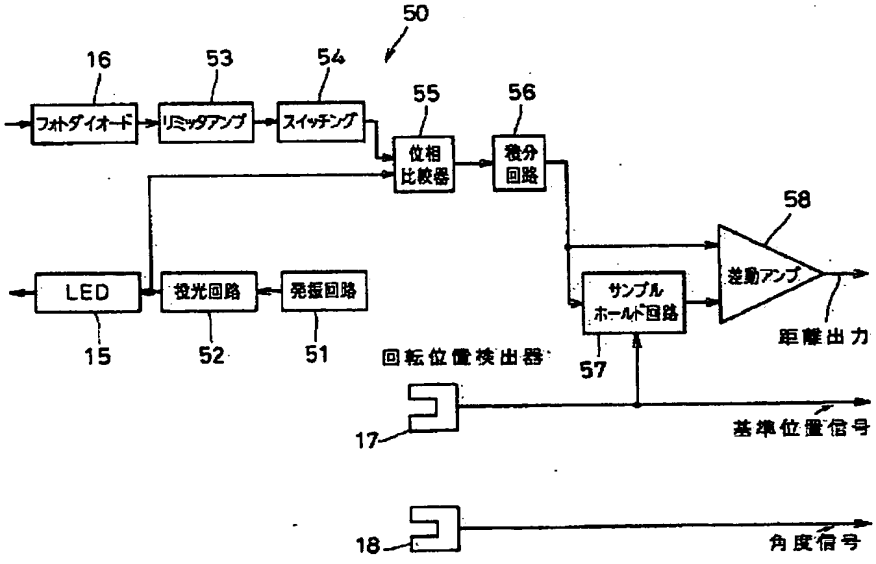
【符号の説明】

１０　ケーシング
１５　発光ダイオード（投光器）
１６　フォトダイオード（受光器）
１７　回転位置検出器
２０　ロータ
２７　光軸変換機構
３０　モータ（駆動機構）
４０　基準機構

【図１】


21
14
15
11a
11
10
30
31
32
13
20
40
27
40
25
23a
23
23b
26
28a
17
18
22
19b
19a
16
12a
14
28b
12

【図２】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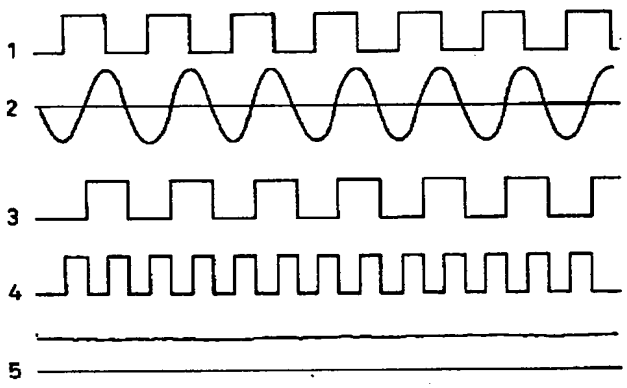
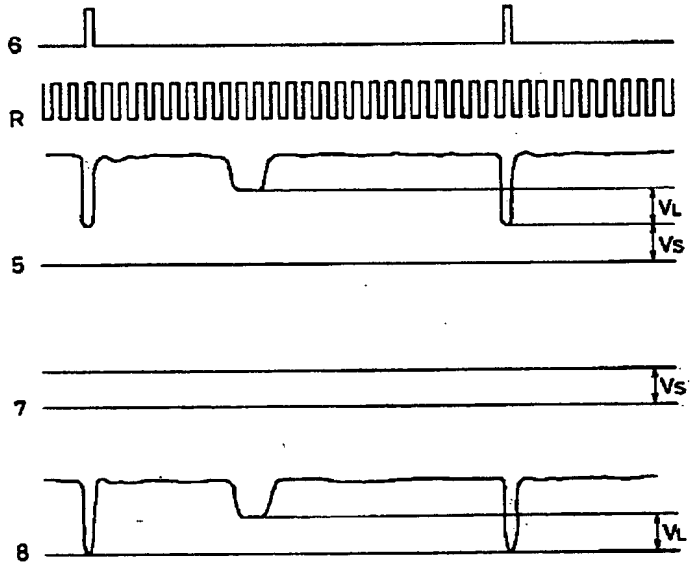
16
53
54
55
56
フォトダイオード
リミッタアンプ
スイッチング
位相比較器
微分回路
58
LED
投光回路
発振回路
サンプルホールド回路
差動アンプ
15
52
51
回転位置検出器
57
距離出力
17
基準位置信号
18
角度信号

【図３】



【図４】



PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-191142
(43)Date of publication of application : 28.07.1995

(51)Int.CI. G01S 17/02
G01B 11/00
G01C 3/06
G01S 7/48

(21)Application number : 05-353622 (71)Applicant : ASTECS KK

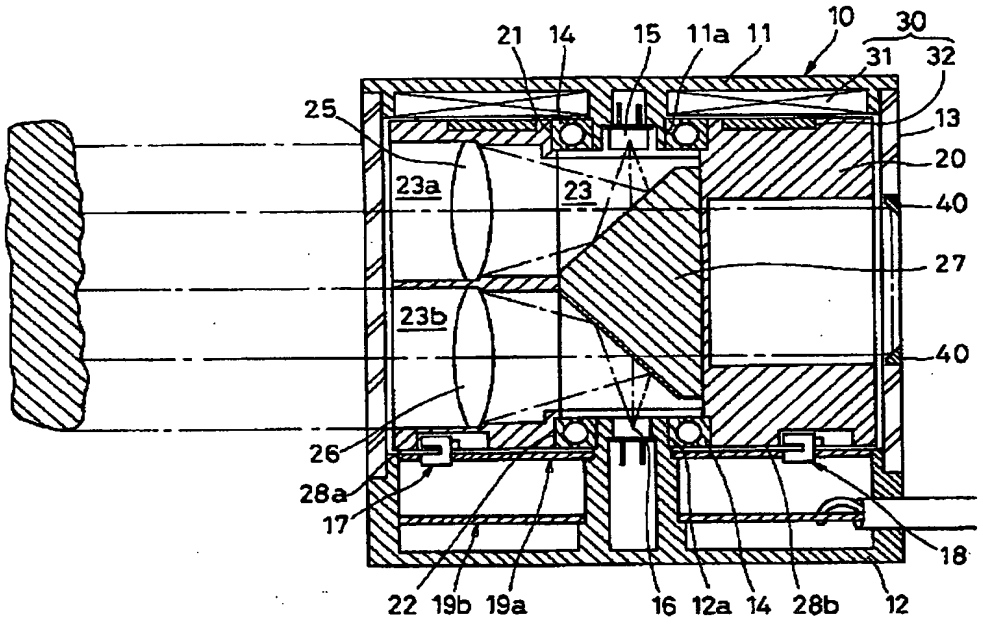
(22)Date of filing : 27.12.1993 (72)Inventor : YAMAMOTO TAKESHI

(54) ALL AZIMUTH DISTANCE DETECTING DEVICE

(57)Abstract:

PURPOSE: To detect presence of an object and a distance to the object if the object is present over a region of nearly 360 degrees by projecting light to the object to accurately detect the distance to the object based on a phase difference and a time difference generated in reflected light thereof with a simple constitution, concentratingly arranging instruments for projecting/receiving the light, and rotating a whole device around these as a center.

CONSTITUTION: This device is provided with a casing 10 with its peripheral wall being optically opened, a rotor 20 provided rotatably around a nearly vertical axis in the casing 10, and a drive mechanism 30 for rotating the rotor 20 relative to the casing 10. The casing 10 is provided with a light projector 15 and a light receiver 16 arranged oppositely on a rotor rotating axis, and a rotation position detector 17 for outputting a signal in accordance with a rotation position of the rotor 20 with respect to the casing 10. The rotor 20 is provided with an optical axis changing mechanism 27 for changing the optical axes of the projector 15 and the receiver 16 to be directed to a detection direction so as to respectively detects a rotation position of the rotor 20 based on an output signal of the rotation position detector 17 and a distance based on a difference between an input signal of the projector 15 and arm output signal of the receiver 16.



LEGAL STATUS [Date of request for examination] 14.07.1998

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3137307

[Date of registration] 08.12.2000

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] While a peripheral wall is equipped with casing opened optically, Rota mostly prepared pivotable in this casing at the circumference of a vertical axis, and the drive made to rotate this Rota to casing The projector and electric eye by which opposite arrangement was carried out on the Rota revolving shaft at the above-mentioned casing, The rotation position sensor which outputs a signal according to the revolution location of Rota to casing is prepared. The optical-axis translator which changes the optical axis of a projector and an electric eye so that it may be suitable in the detection direction is prepared in above-mentioned Rota. Omnidirection distance detection equipment characterized by enabling it to detect the difference of the input signal of a projector, and the output signal of an electric eye to distance for the revolution location of Rota, respectively from the output signal of the above-mentioned rotation position sensor.

[Claim 2] Omnidirection distance detection equipment according to claim 1 with which a drive is the motor formed in the level surface where casing and Rota counter at one, the coil of this motor is prepared in a casing side, and the magnetic pole is prepared in the Rota side.

[Claim 3] Omnidirection distance detection equipment according to claim 1 which enabled it to amend detection distance with an output when the criteria device in which a projector and an electric eye are optically combined by fixed optical-path die length is prepared in casing when Rota is located in a criteria revolution location, and Rota comes to a criteria revolution location.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the omnidirection distance detection equipment which can detect the distance to a body, when a body exists in an objective existence list over about 360 perimeters.

[0002]

[Description of the Prior Art] Conventionally, the thing adapting the principle of triangulation is known as distance detection equipment which detects the distance to a certain body. this detaches only predetermined spacing, prepares a floodlighting component and the photo detector in which location detection is possible, applies the light from a floodlighting component to a body, receives that reflected light by the photo detector, measures "a gap" from the criteria location of that light-receiving location, based on the amount of this "gap", detected [having made and] the distance to a body geometrically, and comes out.

[0003]

[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional thing, since distance is detected geometrically, if the attaching position of a floodlighting component and a photo detector is shifted also a little, it will be out of order from distance with a actual detection distance. Therefore, the optical precision of the whole equipment needed to be maintained to a high level, therefore manufacture and management of equipment took time and effort. Moreover, since fluctuation of an optical axis was made into the problem, to be spot-light was demanded, therefore optical system became complicated and the light exchanged between a floodlighting component and a photo detector had the case where an expensive laser light was needed.

[0004] Moreover, there is want of wanting to remain and reach far and wide in the detection which limited the detection range in the predetermined include angle as such distance detection equipment, and to perform distance detection with a sufficient precision.

[0005] The place which this invention is made paying attention to such a point, and is made into the object While detecting the distance to a body with a sufficient precision with an easy configuration based on the phase contrast or the time difference which applies the light by light emitting diode etc. to a body, and is produced in the reflected light As intensive arrangement of the device ** and for light-receiving is carried out and

the whole equipment is rotated focusing on this, when a body exists in an objective existence list, it is in enabling it to detect the distance to a body over about 360 degrees.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned object, the omnidirection distance detection equipment of claim 1 While a peripheral wall is equipped with casing opened optically, Rota mostly prepared pivotable in this casing at the circumference of a vertical axis, and the drive made to rotate this Rota to casing The projector and electric eye by which opposite arrangement was carried out on the Rota revolving shaft at the above-mentioned casing, The rotation position sensor which outputs a signal according to the revolution location of Rota to casing is prepared. The optical-axis translator which changes the optical axis of a projector and an electric eye so that it may be suitable in the detection direction is prepared in above-mentioned Rota, and it enabled it to detect the difference of the input signal of a projector, and the output signal of an electric eye to distance for the revolution location of Rota from the output signal of the above-mentioned rotation position sensor, respectively.
[0007] Moreover, the omnidirection distance detection equipment of claim 2 is the motor which the drive formed in the level surface where casing and Rota counter in the above-mentioned configuration at one, the coil of this motor is prepared in a casing side, and the magnetic pole is prepared in the Rota side.
[0008] Furthermore, the omnidirection distance detection equipment of claim 3 prepares the criteria device in which a projector and an electric eye are optically combined by fixed optical-path die length in casing, when Rota is located in a criteria revolution location, and it enabled it for an output when Rota comes to a criteria revolution location to amend detection distance in the configuration of claim 1.
[0009]
[Function] In claim 1, as for the light of a projector, the reflected light goes into an electric eye through an optical-axis translator in a body through an optical-axis translator. And the distance from the phase contrast or the time difference of the input signal of a projector and the output signal of an electric eye to a body is detected. And since Rota rotates to casing by actuation of a drive, the distance to a body is detected over about 360 degrees. In that case, the revolution location of Rota to casing is detected based on the output of a rotation position sensor.
[0010] In claim 2, if the induced current is passed in a coil, a motor will function and Rota will rotate to casing.
[0011] In claim 3, if Rota comes to a criteria revolution location, since the lens for floodlighting and the lens for light-receiving will join together optically by fixed optical-

path die length, the phase contrast or the time difference of the input signal of the projector at that time and the output signal of an electric eye is recognized as a reference value according to the above-mentioned optical-path die length, and the amendment which made this zero distance is attained.

[0012]

[Example] Hereafter, an example is explained. In drawing 1 , 10 is cylindrical casing, is equipped with the connection cylinder 13 of the cylindrical shape which connects a superior lamella 11 and an inferior lamella 12, and these superior lamellas 11 and inferior lamella 12 of a disc form, and has opened the peripheral wall of casing 10 optically by forming this connection cylinder 13 by transparence resin. ****** 11a and 12a which start so that it may approach mutually were formed in the part which carries out phase opposite at the core of the superior lamella 11 of the above-mentioned casing 10, and an inferior lamella 12, and radial bearings 14 and 14 have fitted in here in the inner ring of spiral wound gasket. 20 is Rota of the cylindrical shape arranged between the superior lamella 11 of casing 10, and an inferior lamella 12, and the fitting holes 21 and 22 which fit into the outer ring of spiral wound gasket of the above-mentioned radial bearings 14 and 14 are formed in the core of the top face of this Rota 20, and an underside, and it has become the space 23 which is opened and serves as an optical path between this fitting hole 21 and the fitting hole 22. It is constituted so that Rota 20 can rotate to the circumference of a vertical axis mostly within casing 10 by the above configuration. And 30 is a motor as a drive made to rotate Rota 20 to casing 10, and this motor 30 is formed in the level surface where casing 10 and Rota 20 counter at one. That is, while being plane view and forming the coil 31 in the underside of the casing superior lamella 11 by the equiangular distance, the magnetic pole 32 which is plane view and consists of a permanent magnet by the equiangular distance is formed in the top face of Rota 20, and Rota 20 rotates at a predetermined rotational frequency by controlling the induced current passed in each coil 31.

[0013] As a projector, light emitting diode 15 turns an optical axis to the core of ****** 11a of the above-mentioned casing superior lamella 11 just under, it is equipped with it, and the photodiode 16 as an electric eye turns an optical axis right above, the core of ****** 12a of the casing inferior lamella 12 is equipped with it, and opposite arrangement of light emitting diode 15 and the photodiode 16 is carried out on the Rota revolving shaft. On the other hand, in above-mentioned Rota 20, the space 23 mentioned above is opened in one side attachment wall (drawing 1 left side attachment wall), and it is divided into the cartridge space 23a and 23b of two upper and lower sides by the septum, and the lens 25 for floodlighting and the lens 26 for light-receiving are

arranged towards the side (drawing 1 left) which is the detection direction in these space 23a and 23b, respectively in the optical axis. Moreover, the mirror 27 as an optical-axis translator is formed in the way among the above-mentioned space 23. This mirror 27 is the configuration where the vertical end face of the body of the cylindrical shape arranged so that a medial axis may be in agreement with the Rota revolving shaft was excised and obtained at the include angle of about 45 degrees, and makes this excision side a reflector. He is trying to change the optical axis of the above-mentioned light emitting diode 15 and a photodiode 16 into the optical axis of the lens 25 for floodlighting, and the lens 25 for light-receiving according to two reflectors of this mirror 27. Therefore, through a mirror 27 and the lens 25 for floodlighting, in Body X, for light-receiving, the reflected light reaches lens 26, minds the light of light emitting diode 15 mirror 27, and it goes into a photodiode 16.

[0014] Moreover, the criteria device 40 is being fixed to one place of a hoop direction in the connection cylinder 13 of the above-mentioned casing 10. This criteria device 40 has the prism of the couple which counters up and down, and the prism of slanting facing down and the bottom is set as slanting facing up for upper prism in the height of the lens 26 for light-receiving with the height of the lens 25 for floodlighting, respectively. Therefore, when Rota 20 rotates 180 degrees from the condition of drawing 1 and comes to a criteria revolution location, after the light from the lens 25 for floodlighting changes an include angle 180 degrees by up-and-down prism, when it goes into the lens 26 for light-receiving and Rota 20 is located by this in a criteria revolution location, the lens 25 for floodlighting and the lens 26 for light-receiving join together optically by fixed optical-path die length. It is desirable to make it the inspection light which passed prism here by sticking a protection-from-light seal on the periphery side of the above-mentioned criteria device 40, and carrying out protection-from-light processing not leak outside. Since an error will not arise in a reference value if it carries out like this, precision goes up. Moreover, the inspection light reflected by the inner surface of a protection-from-light processing side also contributes to formation of a reference value.

[0015] Moreover, in drawing 1 , 17 and 18 are 1st and 2nd optical rotation position sensors which are fixed to casing 10 and function as an encoder, and they are being fixed to the casing inferior lamella 12 so that the 1st and 2nd gobos 28a and 28b prepared in the underside of Rota 20 may be straddled, respectively. Much notching is prepared in the inner circumference edge of the above-mentioned 1st gobo 28a at equal intervals, and only one notching is prepared in the periphery edge of 2nd gobo 28b, and a pulse signal is outputted according to these notching permitting passage of the light of rotation position sensors 17 and 18. Here, when Rota 20 comes to a criteria revolution

location, positioning of the notching of 2nd gobo 28b is carried out so that it may come to the 2nd rotation position sensor 18. R of drawing 4 is the output signal of the 1st rotation position sensor 17 accompanying a revolution of Rota 20, and 6 is the output signal of the 2nd rotation position sensor 18.

[0016] Furthermore, in drawing 1 , 19a and 19b are the circuit boards, the control circuit 50 is constructed by these circuit boards 19a and 19b, and the above-mentioned light emitting diode 15, a photodiode 16, and the 2nd rotation position sensor 18 are electrically connected to this control circuit 50. Drawing 2 and drawing 3 explain the configuration of the above-mentioned control circuit 50 grade. The oscillator circuit where 51 outputs a clock signal with predetermined frequency, and 52 are floodlighting circuits which adjust the signal sent to light emitting diode 15 based on the clock signal of an oscillator circuit 51 (the output is 1 of drawing 3). On the other hand, the limiter amplifier (the output is 2 of drawing 3) with which 53 amplifies the output of a photodiode 16, and 54 are switching circuits (the output is 3 of drawing 3). Moreover, it is the sample hold circuit which maintains the level of an input signal until, as for the phase comparator (the output is 4 of drawing 3) with which 55 compares the phase of the output of the above-mentioned floodlighting circuit 52, and the output of a switching circuit, and 56, an integrating circuit (the output is 5 of drawing 3) enters and, as for 57, the following trigger enters, and an integrating circuit 56 enters as the input signal, and the signal of the 2nd rotation position sensor 18 is in close as a trigger. 58 is the differential amplifier and outputs the value which deducted the output of a sample hold circuit 57 from the output of an integrating circuit 56. Since the output (distance output) of this differential amplifier 58 is a value according to the phase contrast or the time difference of the input signal of light emitting diode 15, and the output signal of a photodiode 16, the distance from this value to a body is detected.

[0017] And if Rota 20 rotates to casing 10 by actuation of a motor 30 in this condition, the distance output of the differential amplifier 58 is changed according to distance with the body which exists in the direction of an optical axis, and when a body exists in an objective existence list by detecting this, the distance to a body will be detected over about 360 perimeters. That is, 5 of drawing 4 is the output of an integrating circuit 56, and the output of the sample hold circuit 57 where 7 of drawing 4 is updated in the signal of the 2nd rotation position sensor 18 at the carrier beam event, and these differences are outputted from the differential amplifier 58 (8 of drawing 4). Therefore, amendment which made this zero distance by making the output of the integrating circuit 56 when Rota 20 comes to a criteria revolution location into a reference value is carried out. And the revolution location of Rota 20 is separately detected from the

output signal (include-angle signal) of the 1st rotation position sensor 17. In addition, as an output signal which can be taken out to the exterior, the distance output of the differential amplifier 58, the include-angle signal of the 1st rotation position sensor 17, and the reference phase signal of the 2nd rotation position sensor 18 are set up, and these output signals can be processed suitably and can be used.

[0018] Therefore, in the above-mentioned example, while the distance to Body X is detectable with a sufficient precision with an easy configuration based on the phase contrast of light, when the whole equipment is rotated and Body X exists in the existence list of Body X, the distance to a body can be detected over about 360 degrees. Moreover, since the drive 30 was constituted from a motor formed in casing 10 and Rota 20 at one, when the whole configuration is miniaturizable and a rotational noise can be reduced, since it is a brush loess type, there is no lowering of the life by wear of a brush. Since the criteria device 40 was furthermore established, an output when Rota 20 comes to a criteria revolution location can amend detection distance, and the distance to Body X can always be detected to accuracy.

[0019] In addition, although the transparent connection cylinder 13 was formed in casing 10 in the above-mentioned example, you may be the configuration opened thoroughly, without preparing a connection cylinder, and, in short, the peripheral wall should just be opened optically. Moreover, a gear is engraved on the peripheral wall of Rota as a drive, and the configuration which drives this by the pinion, the configuration which makes the idler for actuation contact the peripheral wall of Rota, and other various configurations can be considered. Moreover, the location of a projector and an electric eye may be reversed up and down. Although the floodlighting lens and the light-receiving lens were prepared apart from the projector and the electric eye in the above-mentioned example, a projector and an electric eye with a lens may be used, and it is not necessary to use a floodlighting lens and a light-receiving lens. Furthermore, an optical-axis translator can use prism in addition to a mirror.

[0020]

[Effect of the Invention] As explained above, the omnidirection distance detection equipment of claim 1 Rotate Rota to casing, and it arranges so that this casing may be countered on the Rota revolving shaft in a projector and an electric eye. The optical-axis translator which changes the optical axis of a projector and an electric eye so that it may be suitable in the detection direction is prepared in Rota. From the output signal of a rotation position sensor, since it enabled it to detect the difference of the input signal to a projector, and the output signal from an electric eye to distance for the revolution location of Rota, respectively While the distance to a body is detectable with a sufficient

precision with an easy configuration based on the phase contrast or the time difference of light It is suitable as distance detection equipment carried in order to be able to detect the distance to a body over about 360 degrees and to recognize an obstruction in a self-propelled robot etc., when the whole equipment is rotated and a body exists in an objective existence list.

[0021] Moreover, since the omnidirection distance detection equipment of claim 2 constituted the drive from a motor which consists of a coil prepared in casing, and a magnetic pole prepared in Rota, it was able to show the concrete example of the drive made to rotate Rota to casing.

[0022] Furthermore, since the omnidirection distance detection equipment of claim 3 prepared the criteria device in which a projector and an electric eye were optically combined by fixed optical-path die length in casing when Rota was located in a criteria revolution location, it can amend detection distance with an output when Rota comes to a criteria revolution location, and can always detect the distance to a body to accuracy.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The vertical section side elevation of an example,

[Drawing 2] The block diagram of the control circuit of an example,

[Drawing 3] Drawing showing basic actuation of the control circuit of an example,

[Drawing 4] It is drawing showing actuation of the control circuit at the time of the Rota revolution similarly.

[Description of Notations]

10 Casing

15 Light Emitting Diode (Projector)
16 Photodiode (Electric Eye)
17 Rotation Position Sensor
20 Rota
27 Optical-Axis Translator
30 Motor (Drive)
40 Criteria Device

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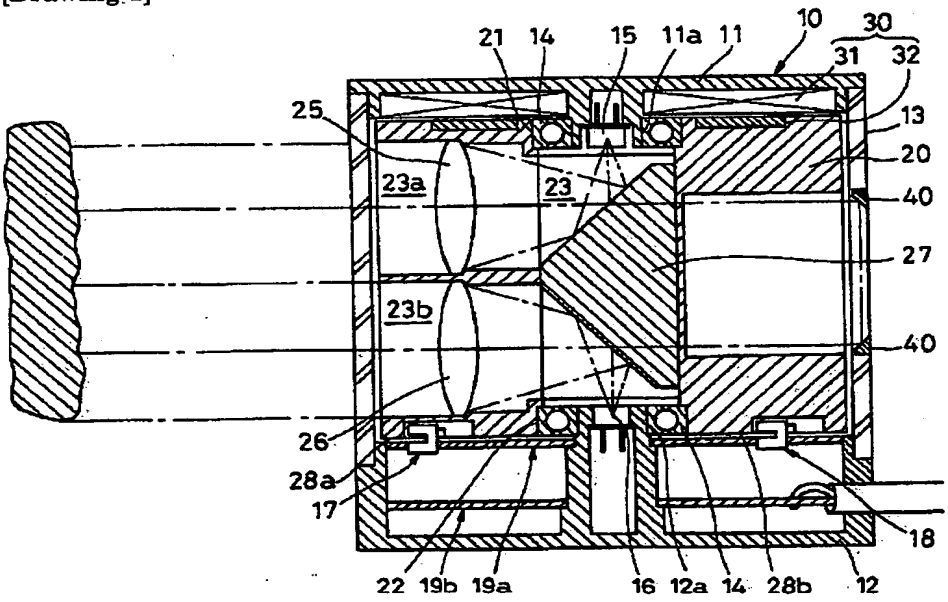
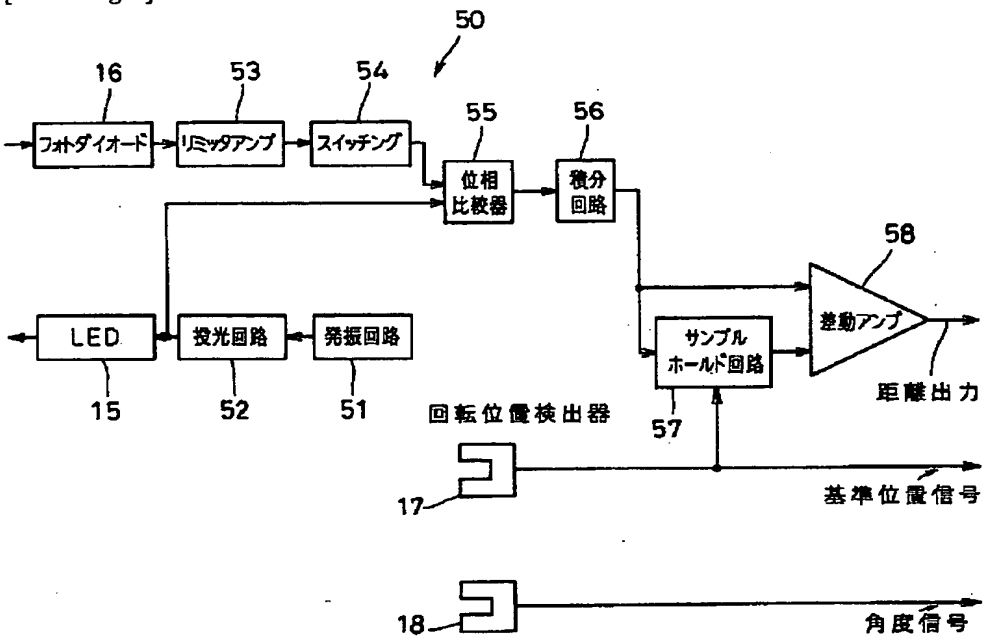
DRAWINGS

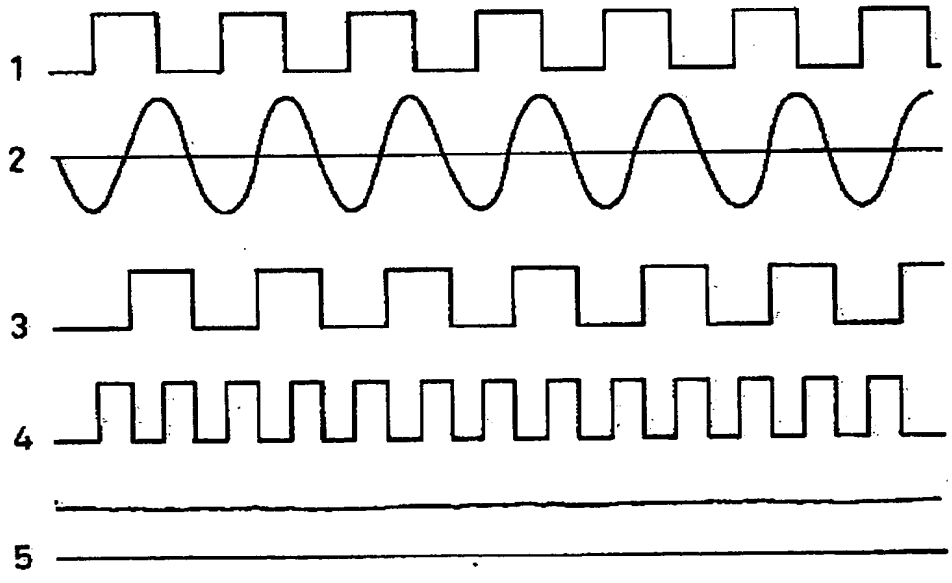
[Drawing 1]



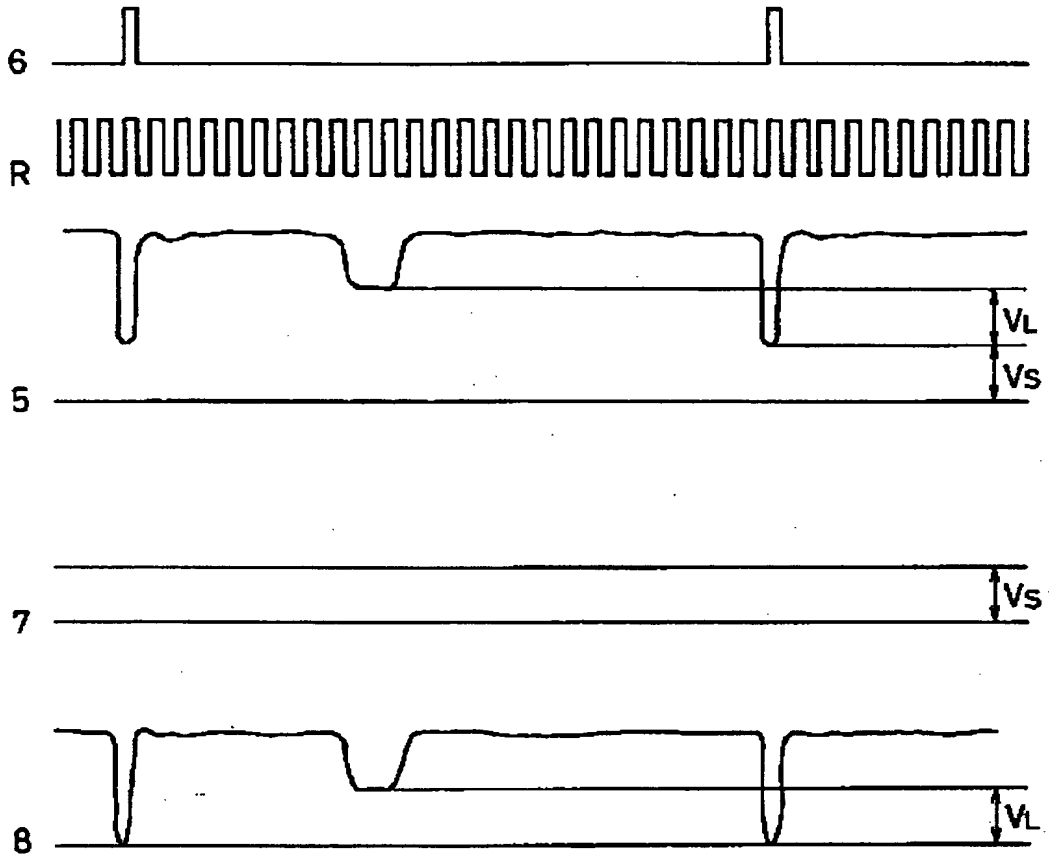
[Drawing 2]



[Drawing 3]



[Drawing 4]



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CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Category partition] The 1st partition of the 6th category
[Publication date] July 30, Heisei 11 (1999)

[Publication No.] Publication number 7-191142
[Date of Publication] July 28, Heisei 7 (1995)
[Annual volume number] Open patent official report 7-1912
[Application number] Japanese Patent Application No. 5-353622
[International Patent Classification (6th Edition)]

G01S 17/02 G01B 11/00 G01C 3/06
G01S 7/48
[FI]

G01S 17/02 A G01B 11/00 B G01C 3/06
Z G01S 7/48 A

[Procedure amendment]
[Filing Date] July 14, Heisei 10
[Procedure amendment 1]
[Document to be Amended] Description
[Item(s) to be Amended] Claim 1
[Method of Amendment] Modification
[Proposed Amendment]
[Claim 1] While a peripheral wall is equipped with casing opened optically, Rota mostly prepared pivotable in this casing at the circumference of a vertical axis, and the drive made to rotate this Rota to casing, The omnidirection distance detection equipment which prepares the projector and the electric eye by which opposite arrangement was carried out on a Rota revolving shaft, and the rotation position sensor which output a signal according to the revolution location of Rota to casing in the above-mentioned casing, prepares the optical-axis translator which changes so that it may turn [Rota / above-mentioned] in the detection direction to the optical axis of a projector and an electric eye, and is characterized from the output signal of the above-mentioned rotation position sensor by enabling it to detect the input signal of a projector, and the output signal of an electric eye to distance for the revolution location of Rota, respectively.

[Procedure amendment 2]

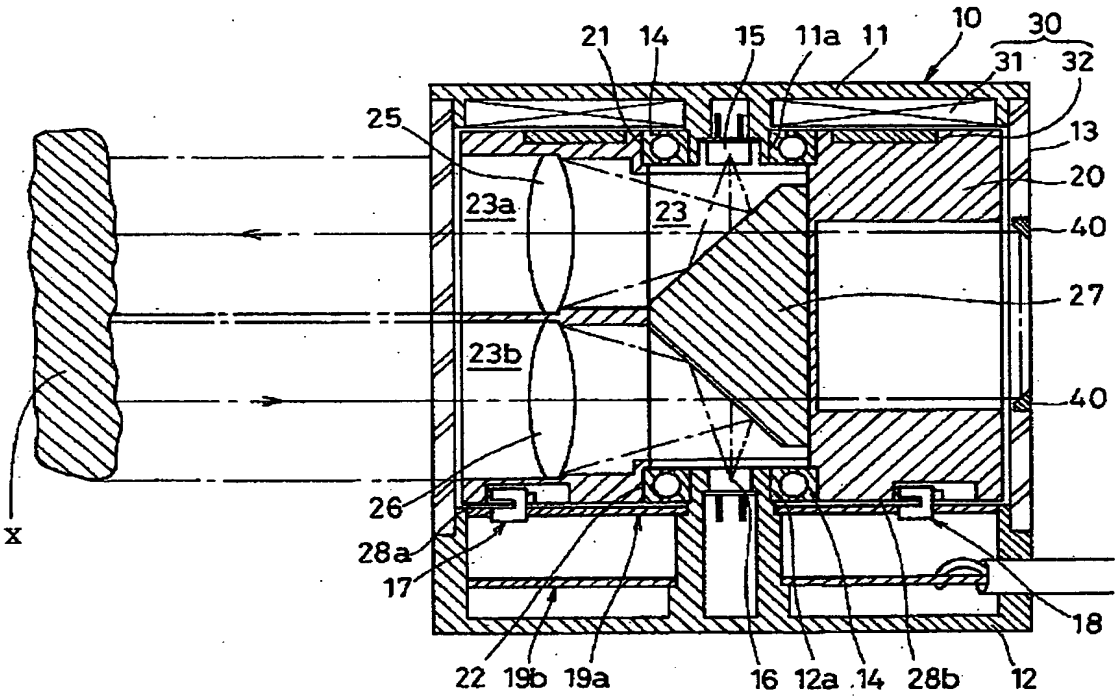
[Document to be Amended] DRAWINGS

[Item(s) to be Amended] drawing 1

[Method of Amendment] Modification

[Proposed Amendment]

[Drawing 1]



[Translation done.]